

**NOTES ON COPEPOD PARASITES OF PHYLLODOCID POLYCHAETE  
WORMS IN SCOTTISH WATERS; INCLUDING THE FIRST UK  
RECORDS OF THE MEDITERRANEAN COPEPOD *Phyllodicola petiti*  
(Delamare-Deboutteville & Laubier, 1960)**

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**INTRODUCTION**

Many parasitic copepods have grossly modified morphology. In some the body is reduced to a simple sack with, at most, minute vestigial appendages and, in egg-bearing (ovigerous) females, a pair of egg sacks (ovisacs). It is not surprising then that copepod parasites of polychaete worms are generally overlooked by benthic ecologists. Those recorded in British waters have recently been reviewed within a synopsis of commensal and parasitic copepods associated with British marine invertebrates (Gotto, 1993). Environmental monitoring surveys of benthic invertebrate communities are proving a fruitful source of new finds of such copepods (O'Reilly, 1995a,b, 1999, Ooishi, 1996).

During the 1990s a small number of copepods from phyllodocid polychaete worms were collected by the author and colleagues in the course of routine marine benthic surveys in Scottish waters. The sampling generally involved collection of seabed sediments by mechanical grab and subsequent sieving on 0.5mm mesh. The retained fauna (and sediment residue) was fixed with formalin and returned to the laboratory for processing (water washing, and dyeing with Rose Bengal to aid sorting). All invertebrates were then picked out, identified, counted and placed in vials with alcohol. Any parasitised polychaetes were put aside for subsequent examination. Phyllodocids were identified using Pleijel & Dales (1991). The copepod material is detailed below along with an additional parasite recovered in the Irish Sea.

**MATERIAL EXAMINED**

(All the material is deposited in the National Museum of Scotland, Edinburgh)

PHYLLODICOLIDAE (Delamare-Deboutteville & Laubier, 1960)

*Cyclorhiza megalova* Gotto & Leahy, 1988

**Scottish Material:**

- a) **Bay of Ireland, Orkney Mainland**, coll. C. Caldwell, April 1990:

1 mature female, 0.7mm, detached from host (*Eteone longa* (Fabricius, 1780)). **NMSZ 2000.055.01**

- b) **Loch Craignish, Argyll**, 10 m depth between Eilean Macaskin & Creag a Bhanan, coll. D. Ross, June 1991:

2 juvenile females, ovoid 0.4 and 0.5mm in length, attached on setigers 78(left) and 81 right) respectively of host (*Eteone longa* - 1.9cm long for 110 setigers, posterior missing). **NMSZ 2000.055.02**

- c) **Firth of Clyde, Girvan**, SEPA Stn.R2 (55° 15.78'N, 4° 51.97'W, depth 10m) coll. M.O'Reilly, Aug.1998:

1 ovigerous female, 0.9mm with broken ovisacs, 0.9 and 1.2mm (plus 2 fragments 1.2 and 2.3mm), attached on setiger 45(left) of host (*Eteone longa* - 2.5cm long for 135 setigers, complete). **NMSZ 2000.055.03** (Fig. 1)

1 ovigerous female, 0.7mm with broken ovisacs 0.7 and 1.4mm, attached on setiger 37(left) of host (*Eteone longa* - 2.2cm long for 145 setigers, complete). **NMSZ 2000.055.04** (Fig. 2)

3 juveniles females, all around 0.15mm, attached on setigers 37(right), 60(right), 70(right) of host, (*Eteone longa* - 1.6cm long for 125 setigers, complete). **NMSZ 2000.055.05**

1 juvenile female, 0.1mm, attached on setiger 90(left) of host (*Eteone longa* - 2.0cm long for 130 setigers, incomplete). **NMSZ 2000.055.06**

**Irish Sea Material:**

- a) **Irish Sea**, Block 109, Stn. 3, (53° 45' 16.2"N, 4° 07' 07.3"W, about 30 miles south-east of the Isle of Man), 46m depth, coll. S. Hamilton, Sept. 1995:

1 ovigerous female, 0.7mm with 1.4mm broken ovisac, attached on setiger 70(right) of host (*Eteone longa* - 1.5cm long for 115 setigers, complete). **NMSZ 2000.055.07**

***Phyllodicola petiti* (Delamare-Deboutteville & Laubier, 1960)**

a) **Firth of Clyde, Irvine Bay**, SEPA Stn.C, (55° 33.60'N, 4° 43.95'W, depth 36m) coll. M.O'Reilly Sept, 1989:

2 juvenile females, ovoid, both around 0.15mm, attached on setigers 38(left) and 41(right) of host (*Phyllodoce rosea* (McIntosh, 1877), 11mm for 50 setigers, incomplete). **NMSZ 2000.055.08**

b) **Firth of Clyde, Ayr Bay**, SEPA Stn. AB1 (55° 27.88'N, 4° 40.00'W, depth 10m) coll. M.O'Reilly, Sept 1989:

1 mature female, 0.3mm attached on setiger 11 (left) of host (*Eumida bahusiensis* Bergstrom, 1914, 42 setigers for 4 mm, complete). **NMSZ 2000.055.09** (Fig. 3)

c) **Island of Mull, Loch na Keal**, SEPA Stn. 22, June 1998:

1 ovigerous female, 0.2mm with ovisacs 0.6 and 1.2mm, attached on setiger 17(left) of host (?*Eumida sanguinea* (Orsted, 1843) , 5.5mm for 47 setigers, complete). **NMSZ 2000.055.10** (Figs. 4 & 5)

d) **Firth of Clyde, Girvan**, SEPA Stn.R2 (55° 15.78'N, 4° 51.97'W, depth 10m), coll. M.O'Reilly, Aug.1998:

1 ovigerous female, 0.3mm with ovisacs 0.8 and 1.1mm, attached on setiger 18(right) of host (*Eumida bahusiensis*, 9 mm for 50 setigers, complete). **NMSZ 2000.055.11** (Fig. 6)

1 mature female, 0.7mm and juvenile female, 0.1mm, on setigers 20(right) and 21(ventral) of host (*Eumida bahusiensis*, 7mm for 39 setigers,complete). **NMSZ 2000.055.12** (Figs. 7 & 8)

**REVIEW OF COPEPODS RECORDED FROM PHYLLODOCID POLYCHAETES**

There are few accounts of copepods associated with phyllodocid worms. The earliest reference is that of Saint-Joseph (1888 pp.295, 302) in his work on polychaetes of the French coast at Dinard. He observed an ovigerous copepod attached to a specimen of "*Eulalia pallida*" (= *Eumida sanguinea*) and another copepod on "*Eulalia macroceros*" (= *Pterocirus macroceros* (Grube, 1860)) referring the latter to *Herpyllobius arcticus* Steenstrup & Lutken, 1861 a highly transformed parasitic copepod described more than 20 years earlier from a polynoid scaleworm off Greenland.

A few years later a new copepod parasite *Nereicola concinna* Scott, 1902 was described from *Eulalia viridis* (Linnaeus, 1767) collected in Loch Etive. Scott (1902) considered his species to be allied to *Nereicola ovatus* Keferstein, 1863 a parasite of nereid worms (see O'Reilly, 1995b) and then the sole member of the Nereicolidae. Several genera have since been added to this family and the hosts, where known, are all polychaetes. However only one genus is associated with phyllodocids and is represented by a single species, *Sigecheres brittae* Bresciani, 1964 ectoparasitic on *Sige fusigera* Malmgren, 1865 in Danish waters. As Gotto (1993) noted it seems almost certain that the copepod described by Scott is congeneric, or perhaps even conspecific with Bresciani's *S. brittae*. Further finds of this form are required to verify this postulation.

In 1942, Heegaard discovered an aberrant copepod on *Eteone longa* collected in Trondheimsfjord, Norway, which he named *Cyclorhiza eteonicola*. Heegaard placed *Cyclorhiza* in the family Herpyllobiidae on account of its grossly simplified morphology.

A new family, the Phyllodicolidae\*, was established by Delamare-Deboutteville & Laubier (1960a) to accommodate another parasite *Phyllodicola petiti* recovered from *Phyllodoce* sp. and *Eulalia pusilla* (= *Eulalia expusilla* Pleijel, 1987) in the eastern Mediterranean. Although Delamare-Deboutteville & Laubier (1960b) discussed the relationship of *Phyllodicola* with other copepod genera parasitising polychaetes, they were unaware of the existence of *Cyclorhiza*. Further illustrations of adult, juvenile, and nauplius stages were presented by Laubier (1961). Around the same time, Gotto (1961) discussed the phylogeny of the Phyllodicolidae and speculated on a neotenous derivation from monstriloids.

It was not until new material of *Cyclorhiza eteonicola* was examined from eastern North America (Lutzen, 1964a) that its resemblance to *Phyllodicola* was realised. Lützen (1964b) subsequently removed *C. eteonicola* from the Herpyllobiidae (which then remained exclusively parasitic on polynoid scaleworms) and placed it in the Phyllodicolidae. Laubier (1966, pp.290-2) accepted that *Cyclorhiza* and *Phyllodicola* were closely related based on Lutzen's comments and unpublished notes by Southward on *C.eteonicola* material collected from the Irish Sea in the 1950s. He also highlighted a further find of an adult and juvenile *P.petiti* from *Pirakia punctifera* (Grube, 1860) in the eastern Mediterranean.

New material of *Cyclorhiza* was discovered by Gotto and Leahy (1988) off western Ireland. Although parasitising the same host as *C.eteonicola*, the Irish material was considered sufficiently distinct to warrant the erection of a new species which they named *Cyclorhiza megalova* on account of the relatively large eggs possessed by the ovigerous females.



### Legends to figures (see opposite page)

Figure 1: *Cyclorhiza megalova* – female with ovisacs attached to *Eteone longa*.

The copepod body is club-shaped with the elongate posterior end bent over between the ovisacs.

Figure 2: *Cyclorhiza megalova* – female with ovisacs attached to *Eteone longa*.

The club-shaped copepod body is visible above the ovisacs with the posterior end bent to the left.

Figure 3: *Phyllodicola petiti* – mature female attached to *Eumida bahusiensis*.

Figure 4: *Phyllodicola petiti* – female with ovisacs attached to *Eumida sanguinea*.

The tiny body of the copepod is hidden by the ovisacs.

Figure 5: *Phyllodicola petiti* – female with ovisacs attached to *Eumida sanguinea*. The tiny oval body of the copepod is visible beside the ovisac.

Figure 6: *Phyllodicola petiti* – female with ovisacs attached to *Eumida bahusiensis*. The tiny body of the copepod is hidden by the ovisacs.

Figure 7: *Phyllodicola petiti* – mature female and juvenile attached to *Eumida bahusiensis*. The tiny oval juvenile is attached just to the left of the much larger mature female.

Figure 8: *Phyllodicola petiti* – mature female attached to *Eumida bahusiensis*.

### DISCUSSION

The sparsity of previous records of copepods from phyllodocid worms is not surprising. The copepods are very small and easily overlooked unless ovigerous. The nereicolids such as *Sigecheres* do have a discernible head with antennae and mouthparts, plus a distinct trunk and tail region and are probably recognisable to most observers as crustaceans of some sort. Nereicolids grasp their host with the oral appendages and thus are liable to become dislodged (and probably lost) from their host during sample sieving or fixing. The phyllodicolids on the other hand have clavate or ovoid bodies and although some cephalic appendages are present these are minute and difficult to observe even on slide mounted material. Phyllodicolids are firmly fixed to their hosts by a buccal siphon and two long rhizoids which penetrate some distance into the host's body. The only obvious indication of their copepodan nature is the relatively large paired egg strings of ovigerous females. Indeed the egg strings often completely obscure the small body of the copepod. Bresciani (1964) suggested that the copepods observed by Saint-Joseph (1888) might be referable to *Sigecheres*. However, Saint-Joseph's identification with *Herpyllobius arcticus*, although erroneous, does imply that their morphology was simplified and thus more akin to phyllodicolids than nereicolids.

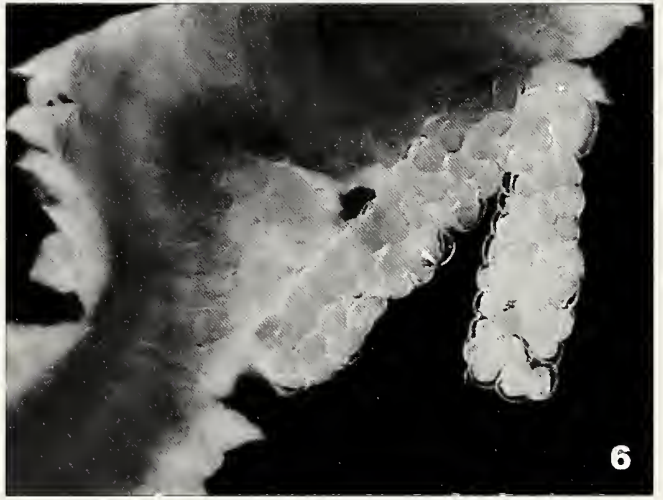
Gotto & Leahy (1988) discuss the difficulty of interpreting Heegaard's inadequate type description of *C. eteonicola*. While they are satisfied that Lützen's material from eastern North America is consistent with Heegaard's description they are convinced that their own Irish material is sufficiently distinct to establish a new species. *C. megalova* is distinguished by the smaller size of its ovisacs. However, the actual eggs are

supposedly larger and as the ovisac matures they develop fibrillar attachment peduncles. Hence, of the Scottish material above, only the two ovigerous specimens can be referred with certainty to *C. megalova*. Gotto & Leahy supposed that Southward's unpublished record of *C. eteonicola* from off the Isle of Man was probably valid, as she had some ovigerous material. However, according to Laubier (1966), Southward observed "peduncular" attachment of the eggs, a characteristic of *C. megalova*. The recovery in 1995 of another ovigerous *Cyclorhiza* specimen south-east of the Isle of Man referable to *C. megalova* casts some doubt on Southward's original identification. The recent record of *C. eteonicola* from off the coast of Northumberland (O'Reilly & Geddes, 2000) comprises 5 non-ovigerous specimens collected in 1982 and thus could also equally be referred to *C. megalova*.

The status of *C. eteonicola* and validity of *C. megalova* clearly require investigation. While Gotto & Leahy suggest that the eggs of *C. megalova*, at 0.1 mm, are much larger, examination of Heegaard's figure would indicate those of *C. eteonicola* are of a similar size, around 0.1 mm (assuming the trunk of his copepod is 2 mm as stated). However, the size of the ovisacs does appear to be different. Those of *C. eteonicola* attaining 8-10 mm with 4 or 5 rows of eggs, whilst *C. megalova* ovisacs are around 2.5 mm long (Irish material) or perhaps up to 3.2 mm long (Scottish material) with 2 to 3 rows of eggs. It seems unlikely that the "fibrillar" attachment exhibited in maturing ovisacs of *C. megalova* (and *P. petiti*) is restricted to these species, and such a process would probably also occur in *C. eteonicola*.

Further material is required to confirm the distinction of these two species. At present the size of the ovisacs is the only reliable differentiating feature. It remains to be established whether *C. eteonicola* genuinely occurs in British waters.







The new finds of *P.petiti* appear to be the first records since Laubier's find in 1966 and represent a considerable extension of its known distribution. As far as can be determined the Scottish material is consistent with the initial descriptions provided by Delamare-Deboutteville & Laubier (1960a) and Laubier (1961) although the oral appendages have not been examined in detail as this would require damage to the specimens.

Mature females of the two phyllocolid genera can be readily distinguished by the body shape. The extended urosome of *Cyclorhiza* results in an elongate clavate, or sausage, shape while *Phyllodicola* retains an irregular ovoid body. Males remain unknown in either of the phyllocolid genera and their discovery could help understand the phylogeny of the family. Specific determination of such small copepods with reduced morphology remains difficult. It might seem surprising that, on the one hand in *Cyclorhiza*, two separate copepod species exclusively adopt the same host species, whilst on the other hand, with *Phyllodicola*, it is assumed that only a single species is involved with five (or more?) acceptable phyllocolid host species. Neither situation is without precedent among polychaete parasites. In the melinnacherids two sibling species, *Melinnacheres terebellidis* (Levinsen, 1878) and *M. steenstrupi* (Bresciani & Lützen, 1961) are both exclusively ectoparasites of *Terebellides stroemi* M.Sars, 1835. In contrast in the Xenocoelomidae, *Aphanodomus terebellae* (Levinsen, 1878) a grossly simplified endoparasite, is recorded from seven species of terebellid polychaetes (see O'Reilly, 1995b). Ultimately genetic studies may aid resolution of these questions.

\*The family was initially named Phyllocolidae by Delamare-Deboutteville & Laubier (1960a). However as the type genus name, *Phyllocola*, had already been used for a genus of beetle, Delamare-Deboutteville & Laubier (1960c) subsequently modified the name to *Phyllodicola* with a corresponding emendation of the family name to its current form, Phyllocolidae.

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## REFERENCES

- Bresciani, J. (1964). *Sigecheres brittae* gen. et sp. nov., a parasitic copepod from the polychaete *Sige fusigera* Malmgren. *Ophelia* **1**, 295-301.
- Bresciani, J. & Lützen, J. (1961). The anatomy of the parasitic copepod *Saccopsis steenstrupi* n.sp. *Crustaceana* **3**, 9-23.
- Delamare-Deboutteville, C. & Laubier, L. (1960a). Les Phyllocolidae, une famille nouvelle de Copépodes parasites d'Annélides Polychètes. *Comptes Rendus Hebdomadaires des Seances, Paris*, **251**, 2083-2085.
- Delamare-Deboutteville, C. & Laubier, L. (1960b). Les Phyllocolidae Delamare et Laubier, Copépodes parasites d'Annélides Polychètes Phyllocolides, et leurs rapports avec les Copépodes annelidicoles. *Comptes Rendus Hebdomadaires des Seances, Paris*, **251**, 2231 - 2233.
- Delamare-Deboutteville, C. & Laubier, L. (1960c). Note rectificative. *Vie et Milieu* **11**, 690.
- Gotto, R.V. (1961). A possible phylogenetic interpretation of the annelidicolous copepod *Phyllocola petiti* Delamare and Laubier. *Evolution* **15**, 564-564.
- Gotto, V. (1993). Commensal and Parasitic Copepods associated with Marine Invertebrates (and Whales). *Synopses of the British Fauna* (New Series) No.46, Universal Book Services/Dr. W.Backhuys, 264 pp.
- Gotto, R.V. & Leahy, Y. (1988). A new annelidicolous copepod, *Cyclorhiza megalova* n.sp., with comments on its functional biology and possible phylogenetic relationships. *Hydrobiologia* **167/168**, 533-538.
- Heegaard, P.E. (1942). *Cyclorhiza eteonicola* n.gen., n.sp., a new parasitic copepod. *Det Kongelige norske videnskabers. Selskab Forhandling* **15**, 53-54.
- Laubier, L. (1961). *Phyllodicola petiti* (Delamare & Laubier, 1960) et la famille des Phyllocolidae, copepodes parasites d'annélides polychètes en Méditerranée occidentale. *Crustaceana* **2**, 228-242.
- Laubier, L. (1966). Le Coralligène des Albères. Monographie biocenotique. *Annales de l'Institut Océanographique, Paris, new series*, **43**, 137-316.
- Lützen, J. (1964a). Parasitic copepods from marine polychaetes of eastern North America. *Le Naturaliste Canadien* **91**, 255-267.
- Lützen, J. (1964b). A revision of the family Herpyllobiidae, (Parasitic Copepods) with notes on hosts and distribution. *Ophelia* **1**, 241-274.
- Ooishi, S. (1996). Two ascidicolid copepods,

- Botryllophilus macropus* Canu and *B. norvegicus* Schellenberg, from British waters. *Journal of Crustacean Biology* **16**, 169-191.
- O'Reilly, M.G. (1995a). A new genus of copepod (Copepoda: Poecilostomatoida) commensal with the maldanid polychaete *Rhodine gracilior*, with a review of the Family Clausiidae. *Journal of Natural History* **29**, 47-64.
- O'Reilly, M.G. (1995b). Parasitic and commensal Copepoda. In: Benthic biodiversity in the southern Irish sea. A.S.Y. Mackie, P.G. Oliver & E.I.S. Rees, *Studies in Marine Biodiversity and Systematics from the National Museum of Wales. BIOMAR Reports*, **1**, 62-69.
- O'Reilly, M.G. (1999). Notes on copepod parasites of polychaete worms in Scottish waters: Including the first UK records of the Californian copepod *Spiophanicola spinosus* Ho, 1984 (Poecilostomatoida: Spiophanicolidae). *Glasgow Naturalist* **23**, 46-47, Plate 3.
- O'Reilly, M.G. & Geddes, D. (2000). Copepoda. pp.217-281, in Vol.1 of: Foster-Smith, J. (ed.) (2000). *The Marine Fauna and Flora of the Cullercoats District: Marine Species Records for the North East Coast of England*. Vol.1 (546pp.), Vol.2 (561pp.) A Dove Marine Laboratory Publication, Penshaw Press, Sunderland.
- Pleijel, F. & Dales, R.P. (1991). Polychaetes: British Phyllodocoideans, Typhloscolecoideans and Tomopterodeans. *Synopses of the British Fauna* (New Series), No.45, Universal Book Services / Dr W Backhuys, 202 pp.
- Saint-Joseph, M de (1888). Les Annélides Polychètes des côtes de Dinard. Seconde Partie. *Annales des Science Naturelle, Zoologie, 7th Serie*, **5**, 141-338.
- Scott, T. (1902). Notes on gatherings of Crustacea collected by the Fishery Steamer "Garland" and the Steam Trawlers "Star of peace" and "Star of Hope", of Aberdeen, during the year 1901. *Twentieth Annual Report of the Fishery Board for Scotland*, 1901, Part 3, pp.447-485, plates 22-25.